

WHAT IS CLAIMED:

1. A peptide which enhances cell growth and/or secretion in a cell culture system, wherein said peptide comprises a structure of at least one of (a) xxxkx, (b) xxkxx, (c) xxxk, (d) xkxxx, and (e) kxxxx, wherein k represents lysine and each x may be the same or different amino acid independently selected from the group consisting of lysine, alanine, isoleucine, phenylalanine, proline, valine, glycine, glutamine, leucine, methionine, asparagine, serine, threonine, tyrosine, aspartic acid, glutamic acid, histidine and derivatives thereof.
2. The peptide of claim 1, wherein the peptide promotes adherence of anchorage-dependent cells on a surface.
3. The peptide of claim 1, wherein the peptide enhances cell growth and is selected from the group consisting of IFFKG (SEQ ID NO:1), FIKFG(SEQ ID NO:2), FIFAK(SEQ ID NO:3), QVVAK(SEQ ID NO:4), FKFIG(SEQ ID NO:5), AFFKI(SEQ ID NO:6), VFPFK(SEQ ID NO:7), AKIFF(SEQ ID NO:8), AFKIF(SEQ ID NO:9), KFAFI (SEQ ID NO:10) and FAKFI(SEQ ID NO:11) and combinations thereof.
4. The peptide of claim 1, wherein the peptide enhances cell secretion and is selected from the group consisting of FKL VY(SEQ ID NO:16), KKKKK(SEQ ID NO:17), KKKKL(SEQ ID NO:18), FK KQ(SEQ ID NO:19), FKFIG(SEQ ID NO:5), KK KSK(SEQ ID NO:20), KK KKL(SEQ ID NO:21), FK KKK(SEQ ID NO:22), LKKKK(SEQ ID NO:23), KKLKK (SEQ ID NO:24), KKKKT(SEQ ID NO:25), KKPKK(SEQ ID NO:26), KKPQY(SEQ ID NO:27), SKKKK(SEQ ID NO:28), KVKKK(SEQ ID NO:29), KNQTY(SEQ ID NO:30), FK KKV(SEQ

ID NO:31), KPKKK(SEQ ID NO:32), FFKKK(SEQ ID NO:33), HKNQT(SEQ ID NO:34), FKLVG(SEQ ID NO:35), KKQPK(SEQ ID NO:36), EKKQT(SEQ ID NO:37), EKKKK(SEQ ID NO:38), KKIQQ(SEQ ID NO:39), KKKKS(SEQ ID NO:40), KKQKK(SEQ ID NO:41), KKLNY(SEQ ID NO:42), DGKKT(SEQ ID NO:43), KKPTT(SEQ ID NO:44), KFIFG(SEQ ID NO:45), FKKMY(SEQ ID NO:46), FFFKK(SEQ ID NO:47), KQKKI(SEQ ID NO:48), HIKKK(SEQ ID NO:49), DFFHK(SEQ ID NO:50), AKKKK(SEQ ID NO:51), AHIKK(SEQ ID NO:52), AHKKK(SEQ ID NO:53), LKLVY(SEQ ID NO:54), PKQKK(SEQ ID NO:55), AKKKT(SEQ ID NO:56).

5. The peptide of claim 1, wherein said peptide is introduced into a cell culture system at a concentration of about 500 μ M to about 6mM.
6. The peptide of claim 1, wherein said peptide is introduced into a cell culture system at a concentration of about 250 μ M to about 24mM.
7. The peptide of claim 1, wherein said peptide is introduced into a cell culture system at a concentration ranging from 3mM to about 12 mM.
8. The peptide of claim 1, wherein said peptide is present on a surface in the form of a dried film.
9. The peptide of claim 8, wherein said surface is two dimensional or three dimensional.

10. The peptide of claim 1 wherein the cell culture system comprises cells selected from the group consisting of epithelial, endothelial, dermal, neural, tumor, lymphocytic, stem cells, and combinations thereof.

11. The peptide of claim 1 wherein said peptide increases oxygen consumption of said cells.

12. The peptide of claim 1 wherein said peptide enhances growth of said cells *in vitro* or *in vivo*.

13. The peptide of claim 1 attached or non-specifically adsorbed to a surface.

14. The peptide of claim 13 wherein said surface is coated with at least one of bovine serum albumin, ovalbumin, keyhole limpet haemocyanin, collagen, fibronectin, laminin, polylysine, a peptide having a cell-surface receptor recognition sequence, an immunoglobulin, a polysaccharide, or a growth factor.

15. The peptide of claim 13 wherein said surface is selected from the group consisting of plastic dishes, plastic flasks, plastic microtitre plates, plastic tubes, sutures, membranes, films, bioreactors, hollow fibers, sacs and microparticles.

16. The peptide of claim 1 covalently linked to a member of the group consisting of extracellular matrix protein, bovine serum albumin, ovalbumin, keyhole limpet haemocyanin,

collagen, fibronectin, laminin, an immunoglobulin, a polysaccharide, a growth factor and combinations thereof.

17. The covalently linked peptide of claim 16 wherein said member is adsorbed to a surface.

18. The covalently linked peptide of claim 16 wherein said growth factor comprises at least one of bFGF, GCSF, an ILGF-1, or VEGF.

19. The peptide of claim 1, wherein the peptide is a media constituent.

20. A peptide which enhances cell growth and/or secretion, the peptide comprising a structure of at least one of (a) xxxkx, (b) xxkxx, (c) xxxxk, (d) xkxxx, and (e) kxxxx, wherein each x may be the same or different hydrophobic or uncharged polar amino acid residue and k represents lysine.

21. The peptide of claim 20, wherein said hydrophobic or uncharged polar residue is selected from the group consisting of Phe, Ile, Ala, Val, Pro, Gly, Gln, Tyr, Thr Leu and derivatives thereof.

22. The peptide of claim 20, wherein the peptide enhances cellular adherence and growth of adherent-type cells and is selected from the group consisting of IFFKG (SEQ ID NO:1), FIKFG(SEQ ID NO:2), FIFAK(SEQ ID NO:3), QVVAK(SEQ ID NO:4), FKFIG(SEQ ID

NO:5), AFFKI(SEQ ID NO:6), VFPFK(SEQ ID NO:7), AKIFF(SEQ ID NO:8), AFKIF(SEQ ID NO:9), KFAFI (SEQ ID NO:10), FAKFI(SEQ ID NO:11), and combinations thereof.

23. The peptide of claim 20, wherein the peptide enhances cell secretion and is selected from the group consisting of FKFIG(SEQ ID NO:5), FKLVEY(SEQ ID NO:16), KNQTY(SEQ ID NO:30), FKLVEY(SEQ ID NO:35), KFIFG(SEQ ID NO:45), LKLVEY(SEQ ID NO:54), and combinations thereof.

24. A peptide which promotes cellular adherence and/or growth, wherein said peptide is selected from the group consisting of IFFKG (SEQ ID NO:1), FIKFG(SEQ ID NO:2), FIFAK(SEQ ID NO:3), QVVAK(SEQ ID NO:4), FKFIG(SEQ ID NO:5), AFFKI(SEQ ID NO:6), VFPFK(SEQ ID NO:7), AKIFF(SEQ ID NO:8), AFKIF(SEQ ID NO:9), KFAFI (SEQ ID NO:10), FAKFI(SEQ ID NO:11), and combinations thereof.

25. The peptide of claim 24 attached or non-specifically adsorbed to a surface.

26. The peptide of claim 24, wherein the peptide is a media constituent.

27. A peptide composition which promotes cellular adherence and/or growth of cells comprising one or more pairs of peptides selected from the group consisting of (a) AFFFQ(SEQ ID NO:12)/EEEMY(SEQ ID NO:13) and (b) FIKLM (SEQ ID NO:14)/FFIPY (SEQ ID NO:15).

28. The peptide composition of claim 27 attached or non-specifically adsorbed to a surface.

29. The peptide composition of claim 27, wherein said composition is a media constituent.

30. A peptide which enhances cell secretion selected from the group consisting of FKL VY (SEQ ID NO:16), KKKKK (SEQ ID NO:17), KKKKL (SEQ ID NO:18), FK K K Q (SEQ ID NO:19), FK FIG (SEQ ID NO:5), KK K SK (SEQ ID NO:20), KK K LK (SEQ ID NO:21), FK K K K (SEQ ID NO:22), LK K K K (SEQ ID NO:23), KK L K K (SEQ ID NO:24), KK K K T (SEQ ID NO:25), KK P K K (SEQ ID NO:26), KK P Q Y (SEQ ID NO:27), SK K K K (SEQ ID NO:28), K V K K K (SEQ ID NO:29), KN Q T Y (SEQ ID NO:30), FK K K V (SEQ ID NO:31), KP K K K (SEQ ID NO:32), FF K K K (SEQ ID NO:33), HK N Q T (SEQ ID NO:34), FK L V G (SEQ ID NO:35), KK Q P K (SEQ ID NO:36), EK K Q T (SEQ ID NO:37), EK K K K (SEQ ID NO:38), KK IK Q (SEQ ID NO:39), KK K K S (SEQ ID NO:40), KK Q K K (SEQ ID NO:41), KK L N Y (SEQ ID NO:42), DG K K T (SEQ ID NO:43), KK P T T (SEQ ID NO:44), KF IF G (SEQ ID NO:45), FK K M Y (SEQ ID NO:46), FF F K K (SEQ ID NO:47), KQ K K I (SEQ ID NO:48), HI K K K (SEQ ID NO:49), DFF HK (SEQ ID NO:50), AK K K K (SEQ ID NO:51), AH IK K (SEQ ID NO:52), AH K K K (SEQ ID NO:53), LK L V Y (SEQ ID NO:54), PK Q K K (SEQ ID NO:55), AK K K T (SEQ ID NO:56), DE E T Y (SEQ ID NO:57), HN P P Y (SEQ ID NO:58), GG H M S (SEQ ID NO:59), AA D E G (SEQ ID NO:60), GG G G S (SEQ ID NO:61), EE G L S (SEQ ID NO:62), HH P S T (SEQ ID NO:63), FH H N T (SEQ ID NO:64), ADE LN (SEQ ID NO:65), KK K K (SEQ ID NO:66), KK K (SEQ ID NO:67), KK (SEQ ID NO:68), Orm Orm Orm (SEQ ID NO:69), RRR (SEQ ID NO:70), and combinations thereof.

31. The peptide of claim 30 attached or non-specifically adsorbed to a surface.

32. The peptide of claim 30, wherein said peptide is a media constituent.
33. A method of modifying a surface in a cell culture system so as to enhance cell growth and/or secretion in said system, comprising the step of applying to said surface a peptide comprising a structure selected from the group consisting of (a) xxxkx, (b) xxkxx, (c) xxxk, (d) xkxxx, (e) kxxxx and combinations thereof, wherein k represents lysine and each x may be the same or different amino acid independently selected from the group consisting of lysine, alanine, isoleucine, phenylalanine, proline, valine, glycine, glutamine, leucine, methionine, asparagine, serine, threonine, tyrosine, aspartic acid, glutamic acid, histidine and derivatives thereof.
34. The method of claim 33 wherein said peptide enhances cell growth and is selected from the group consisting of IFFKG (SEQ ID NO:1), FIKFG(SEQ ID NO:2), FIFAK(SEQ ID NO:3), QVVAKE(SEQ ID NO:4), FKFIG(SEQ ID NO:5), AFFKI(SEQ ID NO:6), VFPEK(SEQ ID NO:7), AKIFF(SEQ ID NO:8), AFKIF(SEQ ID NO:9), KFAFI (SEQ ID NO:10), FAKFI(SEQ ID NO:11), and combinations thereof.
35. The method of claim 33, wherein the peptide enhances cell secretion and is selected from the group consisting of FKLVE(SEQ ID NO:16), KKKKK(SEQ ID NO:17), KKKKL(SEQ ID NO:18), FKKEQ(SEQ ID NO:19), FKFIG(SEQ ID NO:5), KKKE(SEQ ID NO:20), KKKLE(SEQ ID NO:21), FKKEE(SEQ ID NO:22), LKKKE(SEQ ID NO:23), KKLKE (SEQ ID NO:24), KKKKE(SEQ ID NO:25), KKEKE(SEQ ID NO:26), KKEQ(SEQ ID NO:27), SKKKK(SEQ ID NO:28), KVEKE(SEQ ID NO:29), KNQTY(SEQ ID NO:30), FKKEV(SEQ ID NO:31), KPEKE(SEQ ID NO:32), FFKKE(SEQ ID NO:33), HKNQT(SEQ ID NO:34),

FKLVG(SEQ ID NO:35), KKQPK(SEQ ID NO:36), EKKQT(SEQ ID NO:37), EKKKK(SEQ ID NO:38), KKIQK(SEQ ID NO:39), KKKKS(SEQ ID NO:40), KKQKK(SEQ ID NO:41), KKLNY(SEQ ID NO:42), DGKKT(SEQ ID NO:43), KKPTT(SEQ ID NO:44), KFIFG(SEQ ID NO:45), FKKMY(SEQ ID NO:46), FFFKK(SEQ ID NO:47), KQKKI(SEQ ID NO:48), HIKKK(SEQ ID NO:49), DFFHK(SEQ ID NO:50), AKKKK(SEQ ID NO:51), AHIKK(SEQ ID NO:52), AHKKK(SEQ ID NO:53), LKLVY(SEQ ID NO:54), PKQKK(SEQ ID NO:55), AKKKT(SEQ ID NO:56), and combinations thereof.

36. A method of adhering cells to a surface to promote cellular growth comprising the steps of:

- (i) providing a surface at least partially coated with a peptide comprising a structure selected from the group consisting of (a) xxxkx, (b) xxkxx, (c) xxxk, (d) xkxxx, (e) kxxxx and combinations thereof, wherein each x may be the same or different hydrophobic or uncharged polar amino acid residue and k represents lysine; and
- (ii) contacting said at least partially coated surface with said cells for a sufficient time to permit cellular attachment thereto.

37. The method of claim 36 wherein said hydrophobic or uncharged polar residue is selected from the group consisting of Phe, Ile, Ala, Val, Pro, Gly, Gln and derivatives thereof.

38. The method of claim 36 wherein said peptide comprises an amino acid sequence selected from the group consisting of IFFKG (SEQ ID NO:1), FIKFG(SEQ ID NO:2), FIFAK(SEQ ID NO:3), QVVAK(SEQ ID NO:4), FKFIG(SEQ ID NO:5), AFFKI(SEQ ID NO:6), VFPFK(SEQ

ID NO:7), AKIFF(SEQ ID NO:8), AFKIF(SEQ ID NO:9), KFAFI (SEQ ID NO:10), FAKFI(SEQ ID NO:11), and combinations thereof.

39. A cell culture substrate comprising a peptide selected from the group consisting of IFFKG (SEQ ID NO:1), FIKFG(SEQ ID NO:2), FIFAK(SEQ ID NO:3), QVVAK(SEQ ID NO:4), FKFIG(SEQ ID NO:5), AFFKI(SEQ ID NO:6), VFPFK(SEQ ID NO:7), AKIFF(SEQ ID NO:8), AFKIF(SEQ ID NO:9), KFAFI (SEQ ID NO:10), FAKFI(SEQ ID NO:11), and combinations thereof.

40. A cell culture substrate comprising a peptide composition including one or more pairs of peptides selected from the group consisting of (a) AFFFQ(SEQ ID NO:12)/EEEMY(SEQ ID NO:13) and (b) FIKLM (SEQ ID NO:14)/FFIPY (SEQ ID NO:15).

41. A cell culture substrate comprising a peptide selected from the group consisting of FKLVEY(SEQ ID NO:16), KKKKK(SEQ ID NO:17), KKKKL(SEQ ID NO:18), FKKKQ(SEQ ID NO:19), FKFIG(SEQ ID NO:5), KKKSK(SEQ ID NO:20), KKKLK(SEQ ID NO:21), FKKKK(SEQ ID NO:22), LKKKK(SEQ ID NO:23), KKLKK (SEQ ID NO:24), KKKKT(SEQ ID NO:25), KKPKK(SEQ ID NO:26), KKPQY(SEQ ID NO:27), SKKKK(SEQ ID NO:28), KVKKK(SEQ ID NO:29), KNQTY(SEQ ID NO:30), FKKKV(SEQ ID NO:31), KPKKK(SEQ ID NO:32), FFKKK(SEQ ID NO:33), HKNQT(SEQ ID NO:34), FKLVG(SEQ ID NO:35), KKQPK(SEQ ID NO:36), EKKQT(SEQ ID NO:37), EKKKK(SEQ ID NO:38), KKIQQ (SEQ ID NO:39), KKKKS(SEQ ID NO:40), KKQKK(SEQ ID NO:41), KKLNY(SEQ ID NO:42), DGKKT(SEQ ID NO:43), KKPTT(SEQ ID NO:44), KFIFG(SEQ ID NO:45), FKKMY(SEQ ID

NO:46), FFFKK(SEQ ID NO:47), KQKKI(SEQ ID NO:48), HIKKK(SEQ ID NO:49), DFFHK(SEQ ID NO:50), AKKKK(SEQ ID NO:51), AHIKK(SEQ ID NO:52), AHKKK(SEQ ID NO:53), LKLVY(SEQ ID NO:54), PKQKK(SEQ ID NO:55), AKKKT(SEQ ID NO:56), DEETY(SEQ ID NO:57), HNPPY(SEQ ID NO:58), GGHMS(SEQ ID NO:59), AADEG(SEQ ID NO:60), GGGGS(SEQ ID NO:61), EEGLS(SEQ ID NO:62), HHPST(SEQ ID NO:63), FHHNT(SEQ ID NO:64), ADELN(SEQ ID NO:65), KKKK(SEQ ID NO:66), KKK(SEQ ID NO:67), KK(SEQ ID NO:68), OrnOrnOrn(SEQ ID NO:69), RRR(SEQ ID NO:70), and combinations thereof.

42. A peptide library selected from the group of libraries consisting of: (a) xxxkx, (b) xxkxx, (c) xxxk, (d) xkxxx, (e) kxxxx and permutations thereof, wherein k represents lysine and each x may be the same or different amino acid independently selected from the group consisting of lysine, alanine, isoleucine, phenylalanine, proline, valine, glycine, glutamine, leucine, methionine, asparagine, serine, threonine, tyrosine, aspartic acid, glutamic acid, histidine and derivatives thereof.

43. The peptide library of claim 42 wherein said library comprises peptides covalently linked to a member of the group consisting of bovine serum albumin, ovalbumin, keyhole limpet haemocyanin, collagen, fibronectin, laminin, an immunoglobulin, a polysaccharide, a growth factor and combinations thereof.

44. A cell or tissue culture medium including the peptide of claim 1.

45. A cell or tissue culture medium including the peptide of claim 24.
46. A cell or tissue culture medium including the peptide composition of claim 27.
47. A cell or tissue culture medium including the peptide of claim 30.
48. A method for enhancing cellular growth and/or secretion comprising the step of culturing cells or tissues in the presence of the peptide of claim 1.
49. A peptide which enhances cell secretion in a cell culture system, wherein all amino acids of said peptide possess positively charged side chains.
50. The peptide of claim 49 ranging from 2 amino acids to about 20 amino acids.
51. The peptide of claim 49, wherein the peptide enhances cell secretion in said system at a concentration range from about 250 μ M to about 24mM.
52. The peptide of claim 49, wherein said peptide is a media constituent.